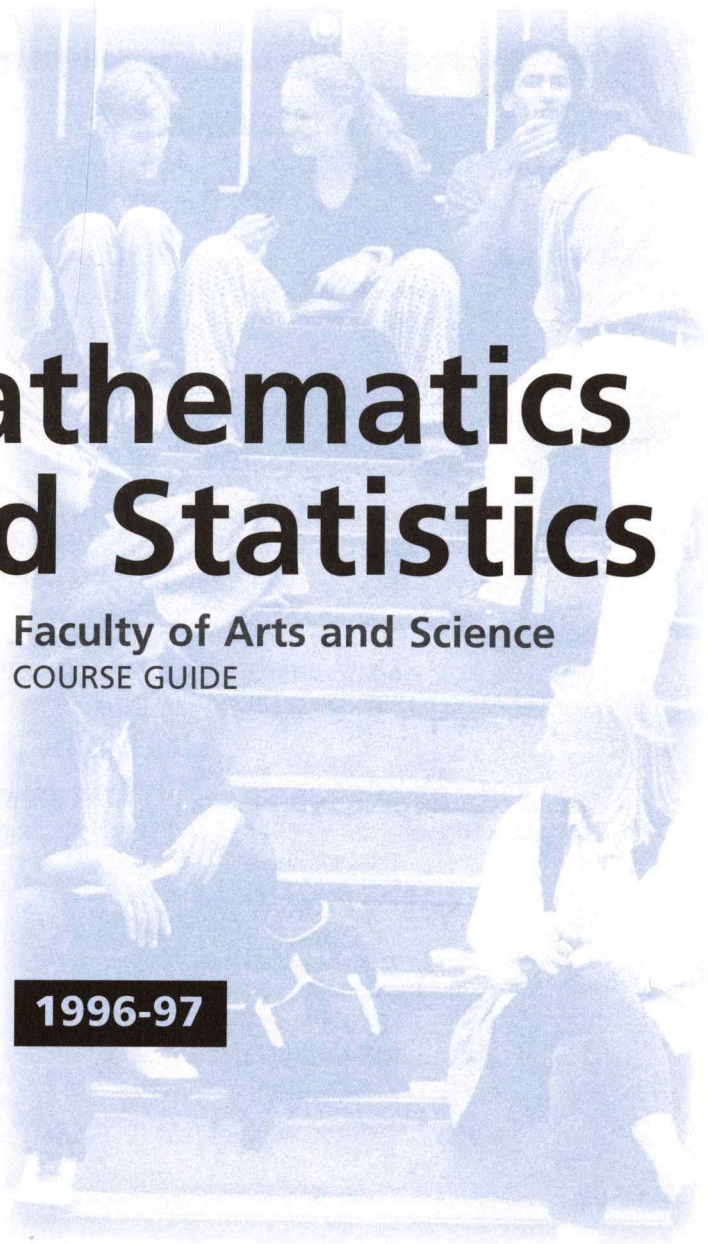

Mathematics and Statistics

Faculty of Arts and Science

COURSE GUIDE

1996-97

Concordia
UNIVERSITY

DEPARTMENT OF MATHEMATICS AND STATISTICS

COURSE GUIDE

1996-97

CHAIR	Dr. Joel Hillel (514) 848-3235
ASSOCIATE CHAIR	Dr. J.C. Turgeon (514) 848-3231
UNDERGRADUATE PROGRAMME COORDINATOR	Dr. M. Belinsky (514) 848-3228
CO-OP PROGRAMME DIRECTOR	Dr. M. Szabo (514) 848-3251
DEPARTMENTAL OFFICES	Sir George William Campus 1400 de Maisonneuve W. Room LB 525 (514) 848-3222 Loyola Campus 7141 Sherbrooke W. Room HB 234 (514) 848-3232

TABLE OF CONTENTS

1. DEPARTMENTAL PROGRAMME OBJECTIVES ... 1

2. FACULTY ... 2

2.1 List of Faculty Members ... 2

3. COMPUTER LABORATORIES ... 3

4. THE UNDERGRADUATE PROGRAMME ... 4

4.1 Co-operative Programmes in Mathematics, Statistics, and Actuarial Science ... 4

4.2 Pure and Applied Mathematics ... 7

4.3 Statistics and Actuarial Mathematics ... 8

5. STUDENT ADVISING AND THE MATHEMATICS HELP CENTRE ... 10

1. DEPARTMENTAL PROGRAMME OBJECTIVES

The main objective of the Department of Mathematics and Statistics is to communicate to students both the beauty and the practical usefulness of mathematics. We convey to our students an understanding of the broad outlines of Pure and Applied Mathematics, Statistics and Actuarial Mathematics to prepare them for jobs in industry and business in which mathematics is playing an increasingly important role and to stimulate their interest in research.

The courses offered by the Department at Concordia foster mathematical thinking and reasoning, developing general problem-solving skills that are an asset to students throughout their career. The Department has embraced the changes manifested in computer technology and educational reform, enriching the learning and intellectual environment. Our flexible yet challenging undergraduate programmes cater to the diverse interests of students who plan to make mathematics their career as well as to those who will use mathematics in other fields.

Graduating students may use their background in mathematics as an entry to other fields. For example, students majoring in Statistics often find jobs in government agencies, in the health sciences, business analysis and economics, while students specializing in Pure and Applied Mathematics are in demand in high technology industries such as aeronautics, and in computer hardware and software companies. A career in teaching is also often a route followed by our graduates. Of course, Actuarial graduates are always sought after by insurance companies and large corporations. Indeed, professional opportunities are available in fascinating and diverse settings. The analytical skills acquired in our Undergraduate Mathematics programme equip the

student with the tools needed for today's high technology market.

2. FACULTY

As a student at Concordia, you will have direct access to a dedicated and dynamic faculty who will help you in your journey through the programme of your choice. This faculty consists of 36 professors many of whom are at the forefront of research in such areas of mathematics as mathematical physics, number theory, statistics, dynamical systems, and chaos theory. They publish extensively in outstanding journals, compete successfully for research funding, and present papers at national and international conferences.

2.1 List of Faculty Members

Dr. S.T. Ali, Professor
Dr. K. Ananssociate Professord, Associate Professor
Dr. M. Belinsky, A
Dr. A. Boyarsky, Professor
Dr. M. Brian, Associate Professor
Dr. J. Brody, Associate Professor
Dr. W. Byers, Professor
Dr. Y.P. Chaubey, Professor
Dr. E. Cohen, Associate Professor
Dr. M. Cohen, Associate Professor
Dr. C. Cummins, Associate Professor
Dr. C. David, Assistant Professor
Dr. T. Dwivedi, Professor
Dr. J. Garrido, Assistant Professor
Dr. P. Gora, Associate Professor
Dr. R. Hall, Professor
Dr. J. Harnad, Professor
Dr. J. Hayes, Associate Professor
Dr. J. Hillel, Professor
Dr. A. Keviczky, Associate Professor

Dr. Z. Khalil, Professor
Dr. H. Kim, Associate Professor
Dr. H. Kisilevsky, Professor
Dr. M.A. Malik, Associate Professor
Dr. J. McKay, Professor
Dr. H. Proppe, Associate Professor
Dr. R. Raphael, Professor
Dr. A. Sierpinska, Associate Professor
Dr. J. Soric, Associate Professor
Dr. T.N. Srivastava, Associate Professor
Dr. R. Stern, Professor
Dr. M. Szabo, Professor
Dr. F. Thaine, Associate Professor
Dr. J.C. Turgeon, Associate Professor
Dr. Y. Wang, Professor
Dr. M. Zaki, Associate Professor

3. COMPUTER LABORATORIES

The departmental computer laboratories - open to undergraduates in Mathematics and Statistics - provides a network of HP workstations running UNIX as well as powerful PC's running high-level programming languages, symbolic mathematical packages such as Scientific WorkPlace, Mathematica and Maple, and the Internet.

4. THE UNDERGRADUATE PROGRAMME

4.1 Co-operative Programmes in Mathematics, Statistics, and Actuarial Science

Students enrolled in these programmes either follow a specialization or an honours stream in their chosen specialty. In addition, most students opt for a minor in a complementary discipline such as Accountancy, Business Administration, Computer Science, Finance, Management or other fields of interest .

The Co-op Admission Process

Co-op students are usually admitted in September, after obtaining their CEGEP diploma. In some cases, they are also admitted in January if their academic and professional profiles make it easy for them to integrate into the regular work-study pattern of their programme. The criteria for admission into a co-op programme in the Department of Mathematics and Statistics include academic excellence and work experience. Admission is a two-stage process: In order to be eligible for co-op, students must have been admitted to the University. The Department then selects suitable candidates through a personal interview process. Students are invited for an interview if their academic record and the additional material which they submit are considered promising. If found suitable, students are recommended to the Institute for Co-operative Education for admission to their chosen programme. In order to be admitted into a co-operative programme, students must demonstrate that in addition to academic excellence, they possess or can acquire quickly the language, writing, computing, and interpersonal skills required by employers. The number of places

in the programmes is limited by the identified opportunities for employment at a given time and by the resources available within the University to provide students with suitable professional guidance and support.

Academic Achievements

Over the years, the co-op students in Mathematics, Statistics, and Actuarial Science have proven to be among Concordia's best graduates. They invariably receive awards and medals for their academic achievements and the Dean's Honour Roll is usually speckled with the names of co-op students.

Work Terms

The co-operative programmes in Mathematics, Statistics, and Actuarial Science involve four compulsory work terms, each lasting at least twelve weeks. For students entering a first-year university programme in September, the first work term begins in May of the next calendar year. After that, students alternate work and study terms. At the end of a work term, they must write and are graded on a work term report. Although the University maintains a network of employers and makes every effort to help students find work term placements, it is up to the students to convince employers in interviews to hire them as full-time employees for a work term. Students on a work term are considered full-time employees and are paid a regular salary commensurate with their level of seniority.

Who hires Co-op Students?

The Department's network of employers of co-op students includes the Quebec and other provincial governments, the federal government, as well as the

private sector: consulting firms, insurance companies, R&D based companies, software companies, and research organizations. Concordia Co-op students are regularly employed in major Canadian cities from Halifax to Vancouver, as well as in the US, England, France, Australia, and other countries

Why Are Co-op Students Hired?

Employers hire Mathematics Co-op students for two main reasons:

i) because they need bright people with good analytical skills and problem-solving experience to fill short-term vacancies; and
ii) to engage in a risk-free search for future employees.

Some companies actually consider co-op graduates to be their most valuable human resource. Several employers are themselves graduates of a Concordia co-op programme and are enthusiastic supporters of the next generation of co-op students.

The Co-op Curriculum

Co-op students in Mathematics and Statistics follow the regular academic programmes in their discipline. Specialized courses are sometimes available on a tutorial basis, if needed. Students in Actuarial Mathematics, on the other hand, follow a discipline-based curriculum. It includes workshops which prepare the students for external professional examinations.

The Employability of Co-op Graduates

Many employers have discovered that even in non-mathematical fields, Mathematics graduates

with good professional skills are among their most valuable employees. Because of the integration of the co-op curriculum into the regular mathematics streams, graduates of the Mathematics, Statistics, and Actuarial Science co-op programmes at Concordia University have demonstrated consistently over the years that they possess superior analytical, problem-solving, and organizational skills, and are virtually guaranteed permanent employment upon graduation.

4.2 Pure and Applied Mathematics

The Department of Mathematics and Statistics offers three programmes in Pure and Applied Mathematics: a Major, a Specialization and an Honours.

Pure Mathematics

Areas of Pure Mathematics that have been traditionally strong at Concordia are number theory and algebra. With the dramatic increase in the use of computers during the last decade, especially the use of symbolic languages such as Mathematica and Maple, subjects such as number theory, algebra and analysis are finding many applications.

Applied Mathematics

The Major programme in Applied Mathematics provides the mathematical background which will allow students in another discipline, e.g., Computer Science, Geography, Economics, Education, and Commerce to pursue the more mathematical aspects of the subjects in their discipline. This is particularly important for those students who intend to enter graduate programmes in those disciplines. The Specialization programme

prepares students with a strong affinity for mathematics to pursue careers in the areas of operations research, system analysis, industrial engineering, econometrics, and transportation science. The Honours programme is intended for students who wish to pursue graduate studies in areas of Applied Mathematics such as numerical analysis, optimization theory, and control theory.

One of the most important area where mathematics finds its applications is physics. Several department members are active in the borderline between the two subjects known as mathematical physics, using a variety of mathematical methods to solve physically motivated problems, or developing new ones for doing so. The principal areas of interest are: quantization methods, coherent states, wavelets, integrable systems, gauge theory and spectral transform methods. The areas of mathematics that enter include: group theory, differential geometry, differential equations, operator theory, as well as combinatorial and algebraic methods.

4.3 Statistics and Actuarial Mathematics

Statistics

First years students are introduced to the fundamental tools of probability which deal with the underlying mathematical structure of the random component of every day systems such as weather temperatures and outcomes of sporting events or gambling. They are also introduced to the elements of statistical analysis of data such as estimating unknown characteristics of populations and deciding whether the results of a poll indicate a significant change in political thinking.

Second and third year students apply and expand on the techniques developed in the first year to such topics as predicting the nature of changing populations, the reliability of certain manufacturing processes, keeping a production process in control, determining the equations that describe demand for certain services, the design and analysis of experiments so that the information sought is most efficiently obtained, designing sampling plans for gathering information, analyzing data that is collected on a regular basis, called a time series, and forecasting future observations.

Actuarial Mathematics

The Department offers a Specialization and an Honour's programme in Actuarial Mathematics leading to a Bachelor of Science or a Bachelor or Arts degree. Both programmes are also offered as co-operative education programmes. As indicated by the name, these programmes differ from programmes in Actuarial Science in that they have a strong mathematical orientation. They were designed for the student interested in a career as an actuary who possesses a keen interest in mathematics and may wish to pursue graduate studies. While providing a thorough mathematical education, these programmes prepare the student for the associateship examination of the Society of Actuaries of the Casualty Actuaries or the Casualty Actuarial Society. Admission is currently limited to forty-five students per year and candidates are selected on the basis of overall academic achievement.

5. STUDENT ADVISING AND THE MATHEMATICS HELP CENTRE

Every student entering a degree programme in Mathematics and Statistics is assigned to a full time faculty member who acts as their advisor and mentor throughout their undergraduate studies.

The Department also runs a Mathematics Help Centre staffed by graduate students and final-year undergraduates. The Help Centre provides personal assistance for students, particularly for first year courses, and helps to smooth the transition from CEGEP to university.